JOINT DMS/NLM INITIATIVE ON GENERALIZABLE DATA SCIENCE METHODS FOR BIOMEDICAL RESEARCH (DMS/NLM)

WEBINAR: November 19, 2018, 1:00 pm – 3:00 PM Eastern

www.nsf.gov/pubs/2019/nsf19500/nsf19500.htm

AGENDA

- Introduction
- Welcome from NSF and NIH Leadership
  - **Juan Meza (NSF/DMS)**
  - **Valerie Florance (NIH/NLM)**
- Overview of Program: Program Directors
  Nandini Kannan (NSF/DMS), Jim Powell (NSF/DMS), Yvonne Ou (NSF/DMS), Jane Ye (NIH/NLM)
- Solicitation Specific Requirements
- Review Criteria
- Q&A

DMS/NLM PROGRAM

- Collaboration between the **Division of Mathematical Sciences (DMS)** at the **National Science Foundation (NSF) and the National Library of Medicine (NLM)** at the **National Institutes of Health (NIH)**
- Focuses on innovative and transformative approaches to address important, **data-driven application areas** at the **intersection of the biomedical and mathematical/statistical sciences**.

DMS/ NLM GOAL

Development of **generalizable frameworks** combining **first principles, science-driven models of structural, spatial and temporal behaviors** with **innovative analytic, mathematical, computational, and statistical approaches** that can portray a fuller, more nuanced picture of a **person's health or the underlying processes**.

DMS/NLM OVERVIEW

- Research motivated by a specific application or dataset; use of **publicly-available biomedical datasets** to validate the proposed models and methodology should be described;
- Encourages development of methods that are **generalizable** and **broadly applicable**;
- Development of **novel mathematical, statistical, or computational models and methodology** to solve **important, data-driven biomedical/health problems.**

DMS/NLM TEAM REQUIREMENTS

- Collaborative efforts that bring together **researchers from the biomedical/health and the mathematical/statistical sciences** communities **are a requirement for this program** and must be convincingly demonstrated in the proposal.

- Of particular interest are **new collaborative efforts** involving mathematicians, statisticians, biomedical scientists, and clinicians.

NLM APPLICATION AREAS

Note: This list is not exhaustive or exclusive

- Finding biomarkers that support effective treatment through the integration of genetic and Electronic Health Records (EHR) data;
- Understanding epigenetic effects on human health;
- Extracting and analyzing information from EHR data;

NLM APPLICATION AREAS (contd.)

Note: This list is not exhaustive or exclusive

- Understanding the interactions of genotype and phenotype in humans by linking human sensor data with genomic data using dbGaP;
- Protecting confidentiality of personal health information; and
- Mining of heterogenous data sets (e.g. clinical and environmental).

RELATED NIH DATASETS

Proposers are expected to list **specific datasets** that will be used in the proposed research and **demonstrate that they have access to these datasets**.

- Clinicaltrials.gov https://clinicaltrials.gov/
- Image data repository - Clinical Center https://www.nih.gov/news-events/news-releases/nih-clinical-center-releases-dataset-32000-ct-images
- Model Organism Databases https://www.genome.gov/10001837/model-organism-databases/

RELATED NIH DATASETS (contd.)

- RefSeq National Center for Biotechnology Information (NCBI) (https://www.ncbi.nlm.nih.gov/refseq/)
- The Human Connectome Project (http://www.humanconnectome.org)
- Adolescent Brain and Cognitive Development (ABCD) Data Repository (https://data-archive.nimh.nih.gov/abcd)

NOTE: The **Data Management Plan** should describe plans to **make the data available to researchers if these data are not in the public domain.**

MODELS AND METHODS

Development of **sophisticated mathematical, statistical, or computational models and methods** to address biomedical data science challenges.

- Modeling and integration of heterogenous data from different sources;
- Incorporation of synthetic data to address bias in a data set;
- Causal Inference and Machine Learning;

MODELS AND METHODS (contd.)

- Construction of methods to handle spatio-temporal dependencies and missingness;
- Model validation, uncertainty quantification, evaluation, reproducibility, and metrics for FAIR (findable, accessible, interoperable or reusable);
- Natural Language Processing approaches that address combinations of structured/ unstructured text.

RESPONSIVE PROPOSALS

- Address specific **data-driven biomedical challenges**
- Use **publicly available datasets**
- Involve **new collaborative efforts** between biomedical/health scientists and mathematical scientists
- Develop **innovative, generalizable and broadly applicable** methods

EMAIL INQUIRIES

- **Contact the Program Directors by email** before submission to **discuss suitability**
- ***Briefly*** address why the proposed study **does not** fit the scope of other NIH institutes
  - Research involving standard tools applied to questions in the scope of other NIH institutes is **not appropriate**
  - Research involving mathematical/ statistical methods without a clear health/biomedical application is also **not appropriate**

EMAIL INQUIRIES (CONTD.)

- Succinctly identify required components of the joint solicitation:
  - **Cross-disciplinary** mathematical/statistical and biomedical/health **collaborations**
  - **Biomedical/health application**
  - **Innovation** and **generalizability** of mathematical/statistical approaches
  - **Publicly available data sets**

PROPOSAL PREPARATION & REVIEW CRITERIA

PROPOSAL PREPARATION GUIDELINES

Full Proposal Submission Window:

January 02, 2019 - January 16, 2019

In addition to the requirements listed in the PAPPG NSF 18-1, special requirements apply

PROJECT DESCRIPTION

The 15 page project description MUST consist of two distinct parts:

(1) A **maximum** of **12 pages** at the beginning of the project description addressing the NSF criterion of **Intellectual Merit**. (Note that this NSF criterion corresponds with the NIH criteria of Significance, Investigators, Innovation, Approach, and Environment)

(2) a **separate section at the end of the project description**, **not more than 3 pages long**, clearly titled "**Broader Impacts**" which must address the NSF criterion of Broader Impacts

RESULTS FROM PRIOR NSF AND/OR NIH SUPPORT

- If any PI (or co-PI) has received NSF or NIH funding with (i) an award with an end date in the past five years, or (ii) any current funding, including any no cost extensions, **information on the award(s) is required**.

- Each PI and co-PI who has received more than one award need only report on the **award most closely related to the proposal**.

RESULTS FROM PRIOR NSF AND/OR NIH SUPPORT

- **No more than five total pages** may be used to describe the results, which must be summarized in a single, separate section, clearly titled "Results from Prior NSF/NIH Support."

- This section may be included ***completely*** in **either** the 12-pages covering Intellectual Merit **or** the 3-pages on Broader Impacts, at the PI's discretion. It **may not** cross the 12 page boundary.

BUDGET

- Award sizes are expected to range from **$200,000 to $300,000 (total costs)** per year with durations of up to 3 years.
- Funding to support international collaborators is rarely provided.
- If funds for a Postdoc are requested, a post doctoral mentoring plan is required.

SUPPLEMENTARY DOCUMENTS

MULTIPLE PD/PI LEADERSHIP PLAN

Multiple PD/PI Leadership Plan: No more than 3 pages and must

- Clearly **identify** the biomedical/health researchers and the mathematical/statistical researchers and **describe their expertise** in the selected field relevant to the project.

- Discuss the role of each investigator, governance and organizational structure of the leadership team and the research project.

MULTIPLE PD/PI LEADERSHIP PLAN (contd.)

- Describe communication plans, process for making decisions on scientific direction, and procedures for resolving conflicts.
- Delineate the roles and administrative, technical, and scientific responsibilities for the project for the lead investigator(s) and other collaborators.
- Describe the distribution of resources to specific components of the project.

PROTECTION OF HUMAN SUBJECTS/USE AND CARE OF VERTEBRATE ANIMALS

- Proposals that involve human subjects or use vertebrate animals **MUST INCLUDE** the information required by both agencies. See the **NSF PAPPG** and the **NIH PHS Form 398** for additional information.

- Information on the use of human subjects and/or vertebrate animals is considered in the review of the proposals.

LETTERS OF COLLABORATION

- Letters of collaboration document significant collaborative arrangements and must be **limited to stating the intent to collaborate** and **should not contain endorsements or evaluation** of the proposed project or investigators (see PAPPG Chapter II.C.2.j). The recommended format is**:**

  "If the proposal submitted by Dr. [insert the full name of the Principal Investigator] entitled [insert the proposal title] is selected for funding by NSF or NIH, it is my intent to collaborate and/or commit resources as detailed in the Project Description or the Facilities, Equipment or Other Resources section of the proposal."

PROPOSAL REVIEW SOLICITATION SPECIFIC REVIEW CRITERIA

MERIT REVIEW

Both NSF and NIH merit review criteria will be used in evaluating proposals.

- Proposals submitted in response to this program solicitation will be reviewed by NSF using a combination of Ad hoc Review and/or Panel Review.

- Awards from this competition may be made by either NSF or NIH at the option of the agencies, not the grantee.

NSF REVIEW CRITERIA

- **Intellectual Merit**: Encompasses the potential to advance knowledge

- **Broader Impacts**: Encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

NIH REVIEW CRITERIA

Overall Impact. Reviewers will provide an **overall impact score** to reflect their assessment of the likelihood for the project to exert a sustained, powerful influence on the research field(s) involved, in consideration of the following review criteria, and additional review criteria (as applicable for the project proposed).

ALIGNING NSF & NIH REVIEW CRITERIA: INTELLECTUAL MERIT

NSF	NIH
Importance within the field, across fields?	**Significance**: Does study address an important issue?
Creativity and originality? Potentially transformative?	**Innovation**: Does project employ novel concepts, approaches or methods?
Well conceived and well organized activities?	**Approach**: Are conceptual framework, design, methods & analyses well developed?
Qualifications of proposer(s)? How is the prior work in the related areas?	**Investigator**: Are the investigator & other researchers appropriately trained & qualified?
Resource availability? Research environment and institutional support?	**Environment**: Does scientific environment & institutional support contribute to probability of success?

NSF BROADER IMPACTS

Broader Impacts encompassing the potential to benefit society and contribute to achieving specific, desired societal outcomes, including:

(1) participation of women, persons with disabilities, and members of **underrepresented groups**

(2) science, technology, engineering, and mathematics **education**

(3) increased **public scientific literacy and engagement** with science and technology

(4) development of a **diverse, globally competitive workforce**

(5) increased **partnerships between academia and industry**

(6) improved national **health, security and economic competitiveness**

(7) enhanced **infrastructure for research and education**

SOLICITATION SPECIFIC REVIEW CRITERIA

- For this solicitation, **clinical**, **biomedical**, and **technological applications** are specifically included among potential societally relevant outcomes, in addition to broader impacts listed on the previous slide.

SOLICITATION SPECIFIC REVIEW CRITERIA

Quality and Value of Collaboration

- Is the **expertise** of the proposers **complementary** and well-suited to the problems being addressed?
- Does the collaboration productively bring together **new combinations of investigators, approaches, or resources**?
- Are the **specific roles** of each PI clear?
- Does the collective team have expertise in **both the quantitative and biomedical/health fields**?
- To what extent is the **novelty of the collaboration** between the biomedical/ health PI(s) and the math/ stat PI(s) presented and justified?

SOLICITATION SPECIFIC REVIEW CRITERIA (contd.)

Generalizability/ Applicability.

- Are the proposed approaches blending **principled, science-based models** with innovative **data-driven and machine learning approaches**?
- Are the methods **generalizable and broadly applicable**?

QUESTIONS?

Q&A 1

- Q. My project involves the application of existing mathematical, statistical, or computational tools to solve biomedical problems. Is that within scope?

- A. **No**. The use of standard approaches in **NOT** appropriate for this competition and should be submitted directly to NIH.

Q&A 2

- Q. My research focuses on general mathematical/statistical methods. Is this within scope?

- A. **No**. Research focused on novel mathematical or statistical approaches that is not tied to a specific biomedical or health data challenge should be submitted to the appropriate DMS program at NSF.

Q&A 3

- Q. My biomedical collaborator has access to a large dataset not in the public domain. Is that acceptable?

- A. This program focuses on generalizable methods so you would need to describe how your approach would be applied to publicly available data.

Q&A 4

- Q. I have expertise in both statistics (mathematics) and biomedical research. Do I need a collaborator?

- A. **Yes**. Proposals must be submitted by an inter- or multidisciplinary team.

Q&A 5

- Q. We have built a software package for a particular biomedical data challenge and would like to extend it to other applications. Is this within scope?

- A. Software development is not within scope. This program requires the development of innovative methods.

Q&A 6

- Q. If my proposal were funded through this activity through NLM, would I lose my Early Stage Investigator (ESI) status ?

- A. **Yes**. The grant mechanism under the solicitation is R01. If you are awarded a grant under the solicitation, you will no longer have ESI status.

Q&A 7

- Q. Can I put my Prior NSF/NIH support section between the Intellectual Merit and Broader Impacts Section?

- A. **No.**